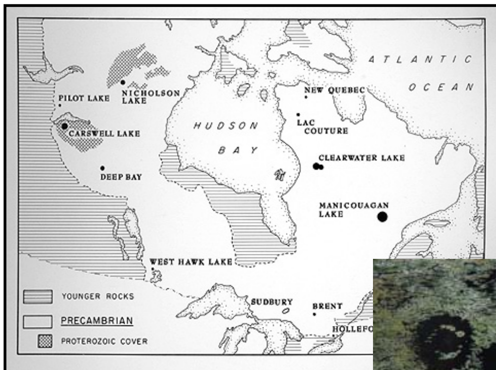
Canadian Shield

Geographical extent

- Most of eastern Canada
- Southern edge of Shield: Minnesota, Wisconsin, Michigan, and southern Ontario

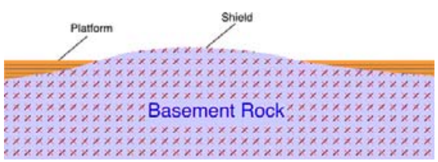
Geology

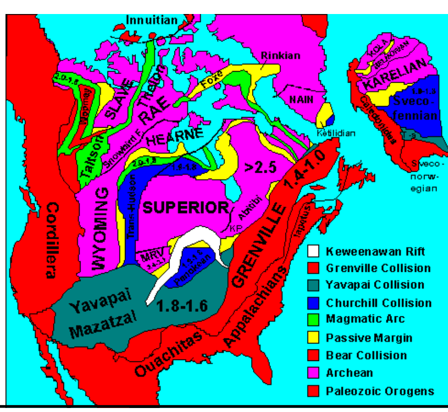
- Sedimentation and igneous activity transposed by metamorphism
- Resulted in recrystallization: very resistant to weathering
  - Lots of granitoid gneiss
  - Little debris from glacial erosion (compared to size of glaciation) because of rock hardness



Basement rock: oldest rock, foundation to continent

- Canadian Shield – largest shield in world
  - Precambrian rock: mostly metamorphic
  - Part of ancient plates welded together
  - First to be above seas





Ancient Topography

- The Shield was originally an area of very large, high mountains with volcanic activity
- Now eroded to its current topographic appearance of relatively low relief.

Precambrian volcanoes

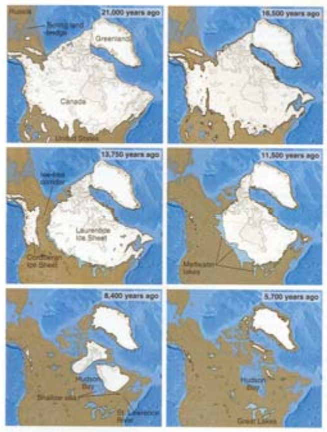
- It contains some of the most ancient volcanoes on Earth. It has over 150 volcanic belts (now deformed and eroded down to nearly flat plains) that range from 600 to 1200 myo.
- Each belt probably grew by the coalescence of accumulations erupted from numerous vents.

Current Topography

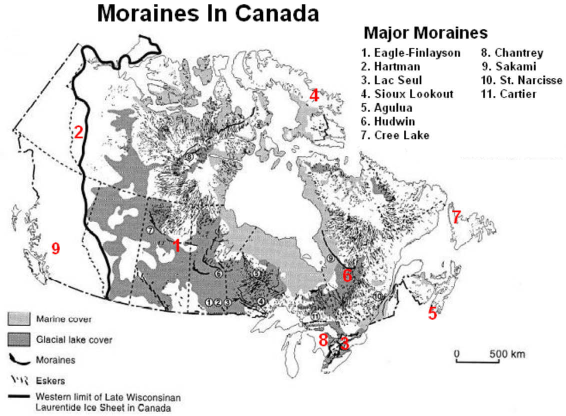
- Rolling hills with low relief
- Elevation of 400-600 m sloping downward towards Hudson Bay
- Northern Quebec and Ungava – higher relief (1,000 m)

Glaciation

- Landscape formed or modified from Laurentide Ice Sheet
- Now contains moraine deposits

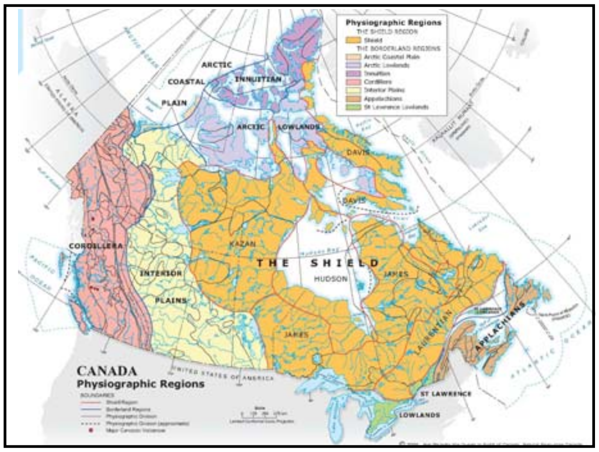


Moraines In Canada



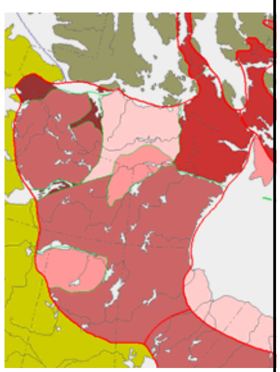
Subdivisions

- Defined by Bostok in 1970 (listed in approx. order of size):
  - James
  - Kazan
  - Laurentian
  - Hudson
  - Davis
- Further divided subdivisions into 7 smaller regions



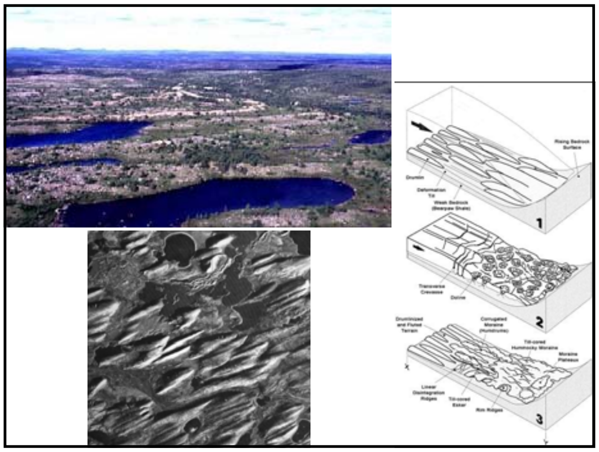
Kazan

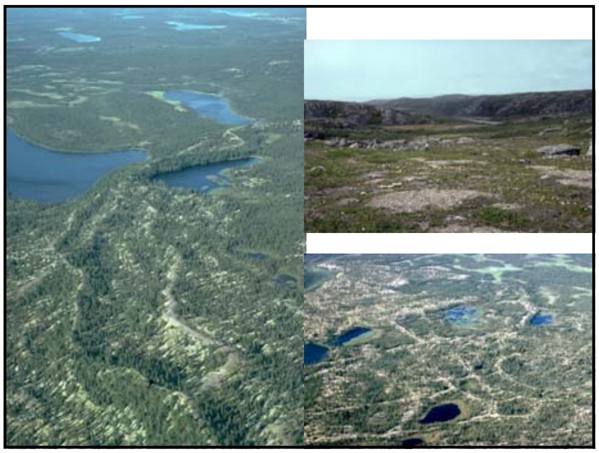
- Vast areas of massive rocks that form flat, broad, sloping uplands, plateaus and lowlands.
- Land characterized by continental glacial deposits
  - Drumlins and eskers



Eskers and drumlins

- Drumlins: fluted till (unsorted glacial debris)
  - Drumlins occur in in masses: called drumlin swarms or drumlin fields
  - Can be curved
- Eskers: Long twisting ridges of sand and gravel. Created when the deposits of subsurface glacial streams are placed on the ground after glacial melting
- Drumlin fields and eskers occur to the west of Hudson Bay

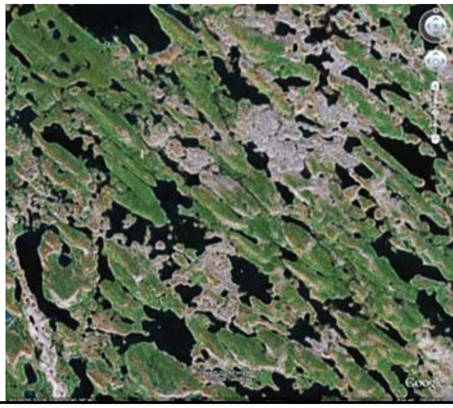




Rankin Inlet – west of Hudson Bay

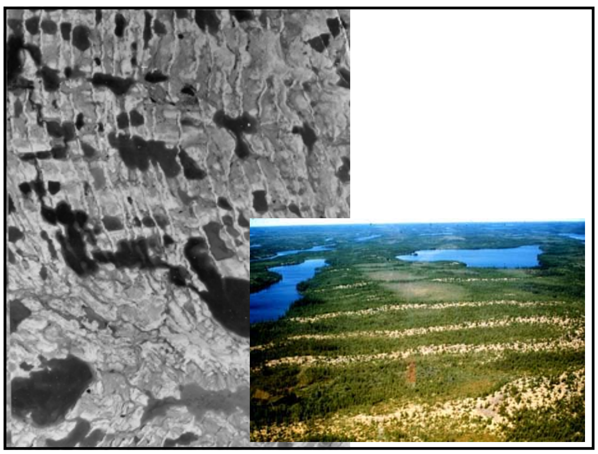
- Lakes are located in grooves created by glaciers
- High points are eskers and drumlins

Rankin Inlet

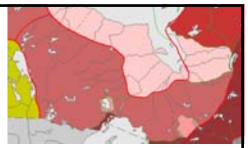


Rogen moraine

- Short sinuous ridges (<2m long & < 10M high) oriented approx. at right angles to local direction of glacial flow
- In Canada, specifically used to describe ribbed moraines
- Also west of Rankin Bay



James



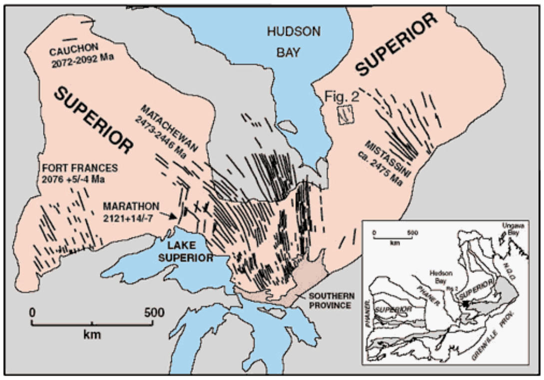
- Uplands and plateaus
- Lies south of the Hudson Region.

Volcanoes

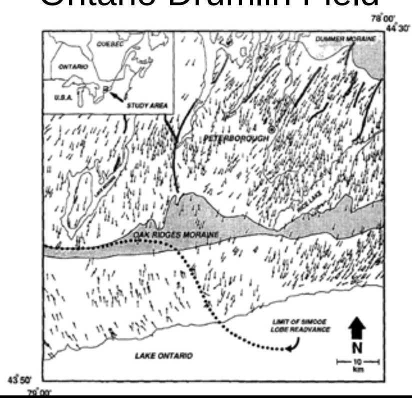
- Sturgeon Lake Caldera in Kenora District, Ontario is one of the world's best preserved mineralized Neoarchean caldera complexes, 2+ billion years old.

Dike Swarms

- Late Archean – Early Proterozoic giant dike swarms exposed in the Canadian Shield.
  - Matachewan dikes: largest dike swarm known on Earth
  - Fort Frances dikes
  - Mackenzie and Mistassini dikes
- No volcanic chains progress from a focus suggested for any of the giant dike swarms.

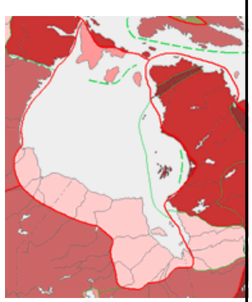


Ontario Drumlin Field



Hudson

- Low, swampy plain with subdued glacial features and a belt of raised beaches that border the bay.
- Also has 2nd largest bay in world.



Hudson Bay

- Depression in central part of Shield
- Paleozoic and Mesozoic sediments (not metamorphic)
- Easily eroded by glaciers: deposited to the south and west
- Maybe the growth center for the Laurentide ice sheet
- Southeastern portion of the bay may be the remnant of a gigantic prehistoric impact structure. Geologists still debate what created the semicircular feature of the bay--some say glaciers, others say an impact that predates the glaciers

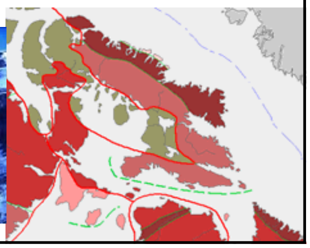
One final word

- Hudson Bay is a basin, approx. 600 feet (182 meters) deep
- Saucer – deep in middle then land rises around it
- Isostatic rebound still occurring – may rebound another 320 feet (100 meters)

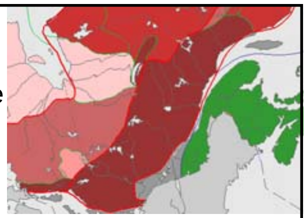
Attawapiskat River mouth, James Bay coast, Ontario

Davis

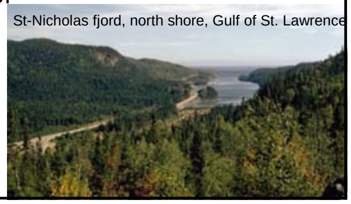
- Broad, old erosion surface almost without surficial deposits
- Along the eastern coast, the relief is generally high.



Laurentian



- Comprises uplands and highlands that rise abruptly above the St. Lawrence Lowlands along northwestern border
- Youngest portion of Canadian Shield



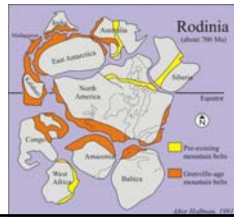
St-Nicholas fjord, north shore, Gulf of St. Lawrence

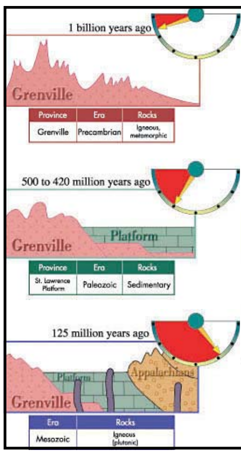
Canadian Orogenies

- Often like continental glaciers: The occurrence of a new episode usually covers up most evidence from the previous one.
- Four major organic episodes, from oldest to most recent: Kenoran, Hudsonian, Elsonian, and **Grenville**

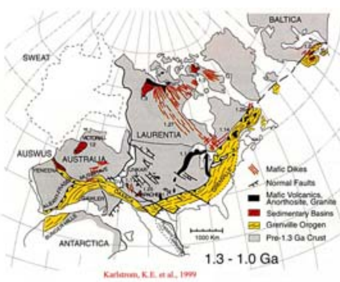
Grenville Orogeny

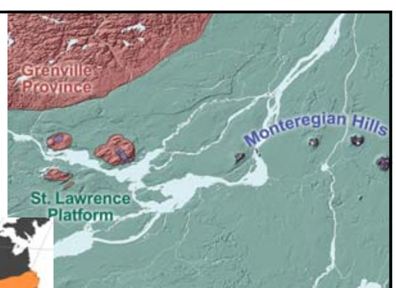
- Accretion of land to the Laurentian craton
- New continental margin was formed
- Responsible for the Laurentian Highlands
- Occurred at the time that Rodinia formed (supercontinent prior to Gondwana, which is prior to Pangea formation)





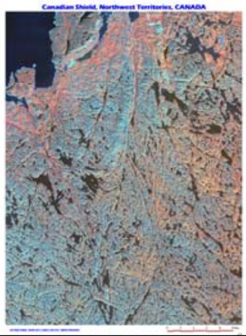
- Eastern edge of Shield





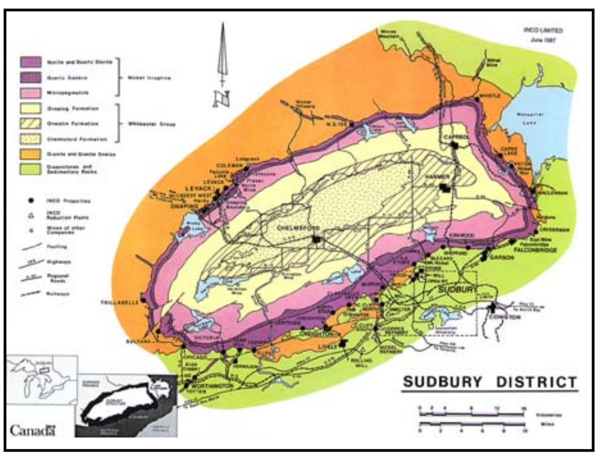
Hydrology

- Bedrock scraped out- form grooves in rock
- Lakes – 1000’s of them
- Kettles
- Some lakes dammed by moraines



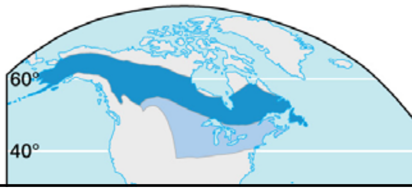
Natural Resources

- Several major ore deposits associated with Precambrian volcanoes.
- Shield has: nickel, gold, silver, and copper.
  - Sudbury, Ontario: nickel and copper
    - Significant evidence that the Sudbury Basin is an ancient meteorite impact crater.
    - The nearby, but less known Temagami Magnetic Anomaly has striking similarities to the Sudbury Basin. This suggests it could be a second metal-rich impact crater.
- In southern Canada, timber is huge resource



Climate

- D climates: Severe midlatitudes
  - Two subtypes located here: Subarctic and Warm, humid continental
- Has greatest range of temperatures between summer and winter
- Long winters influence soil and landform development



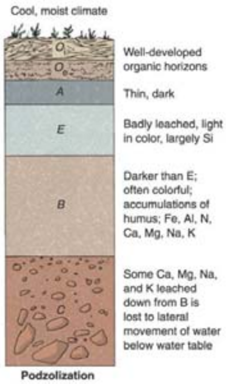
Warm, humid continental

- Found in southeastern Canada and Great Lakes regions: because of continentality, storm paths, and latitude
- Warm summers and long severe winters
- Low precipitation and low evaporation


Soil: podzoliation

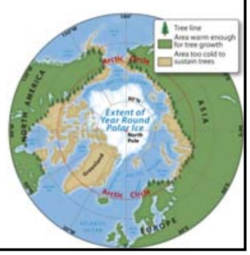
- The regime typically found in the lower area of the Canadian Shield:
  - A thick layer of organic material from vegetation
  - Thin, nutrient poor A layer
  - Grey layers indicating a lack of oxygen

Spodosols



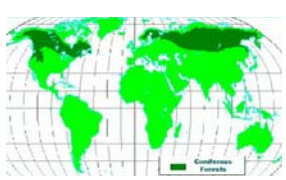
Arctic Treeline

- Located at approx. the middle of Hudson Bay on east side, higher on west side
- Marks transition zone (ecotone) between treeless north (tundra) and the boreal forest to the south
  - Zone can be 100 miles wide
  - Controlled by climate
  - Ground under tundra frozen



Boreal forest (tiaga- “teega”)

- Woodlands and coniferous forest
- Largest terrestrial biome in world - Northern coniferous forest of Northern America and Eurasia
- Region has trees – lots and lots of conifers



Boreal Forest

- Low biodiversity – just a lot of trees
- Species changes as latitude decreases
  - Spruce-Fir Forest
  - Northeastern Pine
  - Central Hardwood (oaks and hickories)
  - Northeastern Hardwood (birch, sugar, red maples)

Vegetation

- In areas of poor drainage, also get bogs
  - In bog, get mat of submerged and floating plants
  - Trees located on bog edges
  - Will eventually fill in – peat deposits
  - Area of richer soil after bog filled in